

Unequal-arms Michelson Interferometers

Massimo Tinto and J.W. Armstrong

Jet Propulsion Laboratory, California Institute of Technology
Pasadena, California 91109

ABSTRACT

Michelson interferometers allow phase measurements many order of magnitude below the phase stability of the laser light injected into their two almost equal-length arms. If, however, the two arms are unequal, the laser fluctuations can not be removed by simply recombining the two beams. This is because the laser jitters experience different time delays in the two arms, and therefore can not cancel out at the photo detector. The method presented in this paper requires a separate readout of the relative phase in each arm, made by interfering the returning beam in each arm with a fraction of the outgoing beam [1]. By linearly combining the two data sets with themselves, after they have been properly time shifted [2], we show that it is possible to construct a new data set that is free of laser fluctuations.

An application of this technique to future planned space-based laser interferometer detectors of gravitational radiation [3] is discussed.

¹ G. Giampieri, R.W. Hellings, M.Tinto, J.E. Faller, *Optics Communications*, **123**, 669, (1996)

² M. Tinto and J.W. Armstrong, *Phys. Rev. D*. In preparation.

³ LISA: (Laser Interferometer Space Antenna) *A Cornerstone Project in ESA's long term space science program "Horizon 2000 Plus"*. MPQ 208, (Max-Planck-Institute für Quantenoptik, Garching bei München, 1995).